

STUDIES ON THE GENUS *BIDENS* L. (COMPOSITAE) FROM THE EASTERN
HEMISPHERE. 8. A RE-EXAMINATION OF TWO ANTHOCYANIC SPECIES
FROM CENTRAL AFRICA

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ABSTRACT

The central African species *Bidens rubicundula* Sherff and *Bidens urceolata* De Wild. are re-examined. They are shown to form a monophyletic group by virtue of a shared synapomorphy: the presence of anthocyanic pigments. Subordinate taxa are recognized for both species. A white flowered form is provided with the name *Bidens rubicundula* forma *alba* T.G.J. Rayner. *Bidens urceolata* is shown to consist of two sympatric variants distinguishable by characters of the capitula. These differences are afforded varietal status requiring the new combination *Bidens urceolata* var. *leptolepis* (Sherff) T.G.J. Rayner (= *Bidens leptolepis* Sherff). A detailed taxonomic appraisal and full synonymy and descriptions are provided for both species.

KEY WORDS: *Bidens*, Compositae, taxonomy, Africa

This paper presents a revision of the closely related species *Bidens rubicundula* Sherff and *B. urceolata* De Wild. Both are slender annual herbs with solitary erect stems rarely exceeding one metre in height, deeply divided leaves, and medium to large showy capitula with usually red or purple ray florets. They possess a largely coincident distribution with both species restricted to south-eastern Zaire and adjacent regions of Zambia. They are chiefly found in the Zambesian phytochorion (*sensu* White 1983) in wetter miombo (deciduous) woodland dominated by *Brachystegia*, *Julbernardia*, and *Isoberlinia*, and more rarely in secondary grassland.

Bidens rubicundula and *B. urceolata* possess a shared character state which strongly suggests that they form a monophyletic group. The red or purple ray florets, which are instantly diagnostic of the clade, are not found elsewhere in

the genus. In all other species the florets are either yellow (occasionally with orange blotches), yellow-orange, cream or white. Consequently this character state is assumed to constitute a synapomorphy. A number of other similarities are also readily apparent. Both species possess usually purplish tinged stems, leaves and inner phyllaries, capitula arranged singly or few in lax cymes, neuter ray florets with stalked glandular hairs, and unwinged, oblong or elliptic, strongly compressed cypselas.

The two species are distinguished by numerous character states, the most important of which are listed in Table 1. Of particular interest in providing further evidence of the monophyletic nature of the two species is the shape of the disc floret corollas. In *Bidens rubicundula* these are bilabiate or rarely unilabiate (character states hitherto unrecorded for the species), whereas in *B. urceolata* they are urceolate. These character states are unique within the genus. In one collection of *B. rubicundula* (Fanshawe F64) a small number of disc florets with urceolate corollas are present. These are sterile with poorly developed stamens and gynaecia and probably represent an atavism. From this it appears that the bilabiate corolla is probably derived from the urceolate type, i.e. the bilabiate corolla has evolved from the urceolate corolla forming an evolutionary transformation series with the former character state apomorphic relative to the latter.

Bidens rubicundula

This is a rare species known only from six collections. It occurs predominantly in the Mwinilunga district of north-western Zambia, with one station in south-eastern Zaire. *Bidens rubicundula* appears to be fairly uniform in its morphology, exhibiting variation primarily in leaf size, leaf lobe width and shape, and inner phyllary and floret colour. The leaves of *Drummond & Rutherford-Smith 7205* reach 13.8 cm in length and possess broad, often falcate lobes up to 5 mm wide. By contrast the leaves of *Robinson 3645* are mostly up to 4-7 cm long and have narrow, straight lobes up to 2 mm wide. The inner phyllaries and florets of most specimens of *B. rubicundula* are strongly pigmented red or purple. In one collection (*Robinson 3634*) the dark pigmentation is mostly absent resulting in white ray florets, yellow disc florets and stramineous inner phyllaries. This albinism is most likely due to a chance association of two recessive alleles for the gene producing anthocyanin. Although many taxonomists rightly refuse to recognize formally such sporadic variants, I feel that an important exception may be made for such a noticeable flower colour variant. As a consequence a new forma *alba* is proposed here.

Bidens rubicundula Sherff, Amer. J. Bot. 41:762. 1954.; Wild, Kirkia 6:14, 15. 1967.; Mesfin, Kew Bull. 48:439, 449, 495. 1993. TYPE: ZAMBIA.

TABLE 1. Morphological differences between *Bidens rubicundula* and *B. urceolata*.

Character	<i>B. rubicundula</i>	<i>B. urceolata</i>
<i>Involucre</i>		
shape	narrowly cylindric and slightly dilated above to infundibular or narrowly campanulate	broadly campanulate or depressed-hemispheric to cupuliform
indumentum	glabrous	sparsely to usually densely pilose at base
<i>Outer phyllaries</i>		
no.	(3-)4-6	(6-)7-16(-19)
apical shape	with a subulate appendage	at most gradually attenuated above
orientation	usually spreading or strongly reflexed often from before anthesis	erect, sometimes spreading at length
no. of nerves	3(-5)	4-9
indumentum	glabrous or ventral surface and margin sparsely pubescent	sparsely to densely pilose chiefly toward base of dorsal surface and apex of margin, rarely glabrous
indumentum colour	red-brown	colourless
<i>Inner phyllaries</i>		
no.	5-6	(5-)7-9(-10)
connation	fused at base	not fused
texture	subcoriaceous to horny and usually callose-indurated below especially in fruit	membranous
<i>Ray florets</i>		
no.	(4-)5-6	4-9(-10)
<i>Disc florets</i>		
corolla shape	bilabiate or rarely unilabiate	urceolate

TABLE 1. (Continued)

<i>Anthers</i>		
size of apical appendages	0.20-0.35 × 0.15-0.20 mm	0.40-0.55 × 0.25-0.35 mm
<i>Cypselas</i>		
margins	incurved, occasionally concealing ventral face	flat
aristae size	0.1-0.3 mm long × 0.03-0.05 mm wide at base	1.1-2.4 mm long × ca. 0.1 mm wide at base
aristae indumentum	nude	retrorely barbed

Chizera, 11 Jun. 1953, *D.B. Fanshawe F64* (LECTOTYPE [selected by Rayner 1992]: K; Isolectotypes: BR,K,SRGH).

Annual herbs, to 70 cm tall; stems solitary, arising from a thin, short (to 0.9-3.1 cm long), often branched taproot, erect, 1.4-3.3 mm diam. near base, simple or few to several-branched chiefly in upper half; stems and branches tetragonal to terete-tetragonal, often more or less terete toward base, 0.5-1.8 mm diam. beneath peduncles, shallow to somewhat deeply sulcate, striate, pale brown-green to purple-brown or red-brown especially above, glabrous or rarely sparsely pilose especially beneath nodes, with minute (ca. 0.05-0.10 mm long), erect to spreading and often variously orientated, more or less weak, uniseriate, few-cellular, basally 2-3-cellular hairs, not or slightly woody at base; branches ascending. Leaves decussate, petiolate or sessile; lamina deeply tripartite or (2-)3-pinnatifid or pinnatisect, with 3-5(-7) segments, narrowly to broadly obtrullate or rarely more or less broadly triangular or narrowly to broadly ovate-obtrullate in outline, (2.5-)3.2-13.8 cm long × 0.8-15.7 cm wide, papyraceous to subcoriaceous, pale to dark grey-green often tinged red or purple, more or less glabrous or more rarely sparsely pilose chiefly on adaxial surface, with minute (to 0.1 mm long), variously orientated, weak, uniseriate, few-cellular hairs, margins sometimes with isolated, minute (to 0.05-0.15 mm long), antrorse, several-cellular, basally 2 to few-cellular hairs; primary leaf segments opposite to subopposite, more rarely alternate, antrorsely inserted at 25-90° to rachis, straight to retrorely falcate; segments and undivided leaves narrowly linear to linear or most narrowly ovate-linear to elliptic-linear, gradually attenuated above to the acute to subacute or sometimes acuminate, slightly callose-indurated apex and also usually below to the more or less narrowly cuneate base, entire at margin, 0.6-11.2 cm long × 0.3-5.0 mm wide, apical segment generally longer and slightly broader than lateral segments; petioles to 0.2-3.4 cm long × (0.3-)0.7-3.2 mm wide, unwinged or narrowly to often broadly winged at margin, with wings to 1.5 mm wide, often strongly involute and concealing the ventral surface at least medially, usually gradually

attenuated from apex toward middle and somewhat dilated and clasping stem at base, pale to dark grey-green, often tinged red or purple especially near base, glabrous or most rarely sparsely pilose; rachis obtriangular, to 2.7-4.8 mm wide beneath segments, to 0.8-1.3 mm wide above segments; uppermost leaves frequently alternate, sessile or shortly petiolate, tripartite, bilobed or rarely undivided, to 0.5-6.2 cm long \times 0.2-4.1 mm wide. Capitula radiate, heterogamous, erect, 2.4-7.1 cm diam. \times 0.9-1.5 cm high at anthesis, 0.8-1.9 cm high in fruit, 2-6(-9) in lax cymes, rarely solitary at stem and branch apices; receptacles more or less flat; peduncles to 1.8-7.3 (-10.3) cm long, 0.4-1.5 mm diam. at anthesis, to 2.3(-2.9) mm diam. in fruit, often slightly dilated immediately beneath capitulum, tetragonal to terete-tetragonal, sometimes acute-angled tetragonal or even more or less winged, shallow to more or less deeply sulcate, glabrous or rarely with isolated, minute (to 0.10-0.15 mm long), variously orientated, weak, uniseriate, basally 1-3-cellular, few-cellular hairs; ebracteate or often with 1-3(-4), alternate, 0.4-4.2 cm long \times 0.2-2.8 mm wide bracts intermediate in shape, texture and nervation between the leaf segments and outer phyllaries. Involucre narrowly cylindrical and slightly dilated above to infundibular or narrowly campanulate, glabrous; outer phyllaries uniseriate, (3-)4-6, narrowly ovate to narrowly elliptic-ovate or narrowly oblong and slightly dilated at base, abruptly attenuated above into a subulate, often strongly incurved appendage, acute or subacute at apex, entire at margin, 2.1-11.8 mm long \times 1.1-2.9 mm wide at anthesis, unchanged or often shrivelled in fruit, usually spreading or strongly reflexed often from before anthesis, papyraceous to subcoriaceous, pale to dark grey-green, with 3(-5), longitudinal, red-brown nerves often interrupted by or associated with subepidermal spherical inclusions, at least the central nerves percurrent and often paired, glabrous or ventral surface and margin sparsely pubescent, with minute (ca. 0.05-0.10 mm long), uniseriate, few-cellular hairs with red-brown contents, incurved part of dorsal surface usually more or less densely covered with colourless translucent tubercles; inner phyllaries uniseriate, fused at base, 5-6, narrowly to moderately elliptic-oblong or obovate-elliptic to more or less broadly elliptic, acute to obtuse at apex, entire at margin, 5.5-14.3 mm long \times 2.3-5.6 mm wide at anthesis, to 16.0(-18.6) mm long \times to 7.8(-9.1) mm wide in fruit, erect, subcoriaceous to horny, usually callose-indurated below especially in fruit, dark red-brown or purple-brown, rarely dark stramineous and sometimes tinged purple-red especially when dry, with a pale stramineous to colourless, to 0.10-0.25 mm wide margin, with 16-numerous, darker, more or less closely spaced, longitudinal, percurrent nerves, minutely puberulous at apex. Ray florets (4-)5-6, neuter; ovary narrowly oblong, 1.5-2.6 mm long \times 0.3-0.6 mm wide, glabrous, exaristate or minutely biaristate, style absent; aristae ca. 0.05-0.10 mm long, nude; corolla tube 1.3-3.1 mm long, sparsely pubescent, with 0.1-0.3 mm long, few to several-cellular, uniseriate, more or less flexuous, weak hairs; ray bright pink to pink-purple, red-purple or red,

rarely white, narrowly obovate-elliptic to narrowly elliptic, 0.8-3.7 cm long \times 3.2-8.3 mm wide, with (4-)5-9, slightly darker, mostly percurrent nerves, sparsely pubescent on nerves of dorsal surface especially toward base and often sparsely glandular hairy on dorsal surface and toward base of margin, with 0.2-0.4 mm long, erect, stalked hairs; apex subobtuse to rounded, entire or 1-3-denticulate, with more or less irregular, acute teeth with sinuses to 0.1-0.4 mm long. Paleae narrowly ovate-elliptic to linear-elliptic, acute at apex, entire at margin, 3.6-7.5 mm long \times 0.6-2.6 mm wide at anthesis, to 12.2 mm long \times to 3.3 mm wide in fruit, more or less flat at anthesis, clasping cypselas in fruit, thin and membranous, glabrous, pale stramineous or pale yellow, more or less colourless at the 0.1-0.3 mm wide margin, with 8-26, brown, slightly darkened toward apex, longitudinal, percurrent, mostly paired nerves, margin often recurved in fruit. Disc florets 17-30; corolla bright pink to pink-purple, red-purple or red, rarely yellow, glabrous or limb sparsely glandular hairy in upper half and sometimes sparsely pubescent at base, margin of lobes papillose; limb bilabiate, divided almost to base, very rarely unilabiate, 2.5-4.4 mm long, larger lip obovate-elliptic, 2.3-3.7 mm long \times 1.6-2.1 mm wide, incurved or more rarely more or less recurved, truncate and 4-lobed at apex, with lobes ovate-triangular, acute to subobtuse at apex, 0.5-0.8 mm long \times 0.3-0.5 mm wide, smaller lip narrowly oblong, usually gradually attenuated above to the acute to subobtuse apex, 2.0-3.6 mm long \times 0.4-0.6 mm wide, spreading to reflexed, very rarely absent; limb not annularly thickened, abruptly attenuated below into a narrow, 1.9-2.8 mm long \times 0.3-0.6 mm diam., terete tube inclined at 25-70° to the vertical; anthers 2.0-3.5 mm long \times 0.4-0.7 mm diam., dark brown-purple, sometimes spirally twisted, long exerted; endothelial tissue with polarized thickening; apical appendages ovate-trullate, acute at apex, 0.20-0.35 mm long \times 0.15-0.20 mm wide, margins reflexed; basal appendages sagittate, not or almost reaching, rarely slightly exceeding base of the filament collar; collar (0.15-)0.30-0.40 mm long \times 0.1-0.2 mm wide; filament 0.9-1.7 mm long, canaliculate; style 5.3-9.4 mm long, not bulbous at base, with caudate, 0.9-1.3 mm long branches; stylopodium cupuliform to cylindrical. Cypselas unwinged; body narrowly oblong-elliptic, gradually attenuated toward apex, 6.9-13.2 mm long \times 0.5-1.5 mm wide, shiny, rust-brown to brown-black-purple, more rarely grey-black, strongly compressed; margins incurved, occasionally concealing the strongly concave ventral face; dorsal face more or less irregularly and strongly convex, occasionally carinate; both faces finely and shallow longitudinally sulcate, margin sparsely, and sometimes ventral surface most sparsely antrorsely, more or less adpressed setose especially above, with setae 0.05-0.10(-0.15) mm long, often arising from rust-brown tubercles; apex slightly expanded with a flattened cartilaginous thickening, glabrous or sparsely setose, laterally biaristate or sometimes exaristate; aristae erect, rigid, subulate, pale stramineous, to 0.1-0.3 mm long \times 0.03-0.05 mm wide at base, nude; base of cypselas with an often subglobose, pale beige,

thin, skin-like covering, to 0.10-0.25 mm long enclosing fruit and attached to a 0.2-0.5 mm long \times 0.45-0.50 mm wide, vertically produced cartilaginous carpodium, frequently with a slightly dorsally produced, linear, ca. 0.20-0.25 mm long abscission scar.

FLOWERING. Mid March to mid June.

HABITAT. *Brachystegia* woodland; damp grassland; lateritic gravel. Alt. 650-1400 m.

Bidens rubicundula Sherff forma *rubicundula*

Inner phyllaries dark red-brown or purple-brown; ray and disc florets bright pink to pink-purple, red-purple or red.

SPECIMENS EXAMINED: ZAIRE. Shaba Province - Kilenge [09° 08' S 25° 52' E], alt. 650 m, 18 Mar. 1971, *M. Lukuesa 997* (K).

ZAMBIA. North-Western Province - Mwinilunga [11° 44' S 24° 24' E], 7 Jun. 1974, *S.M. Chisumpa 152* (MO,NDO); 11 km W of Chizera [13° 08' S 24° 53' E], 23 Mar. 1961, *R.B. Drummond & R.O.B. Rutherford-Smith 7205* (BR,K,LISC,M,PRE,SRGH); Chizera [13° 08' S 25° 00' E], 11 Jun. 1953, *D.B. Fanshawe F64* (BR,K[2 sheets],SRGH); Kabompo Gorge [12° 05' S 25° 11' E], 18 Apr. 1965, *E.A. Robinson 6628* (EA,K,M).

***Bidens rubicundula* Sherff forma *alba* T.G.J. Rayner, forma nov.** TYPE: ZAMBIA. North-Western Province - Kalenda Plain, Matonchi [11° 39' S 24° 06' E], alt. 1400 m, 16 Apr. 1960, *E.A. Robinson 3634* (HOLOTYPE: K; Isotypes: BR,EA,M[2 sheets],SRGH).

Forma nova a *Bidens rubicundula* Sherff forma *rubicundula* phyllariis interioribus multo pallidioribus atrostramineis interdum purpureo-rubris suffusis praesertim in sicco, flosculis radii albis, flosculis disci flavis differt.

Inner phyllaries dark stramineous, sometimes tinged purple-red especially when dry; ray florets white; disc florets bright yellow.

Bidens urceolata

This species is far more common than *Bidens rubicundula*, being described as "locally abundant" (*Lawton 856*) and growing "in great abundance" (*Anton-Smith Z.M. 98*). It is found chiefly in Shaba Province of south-eastern Zaire and more rarely in neighbouring regions of Zambia.

Bidens urceolata was described by De Wildeman (1903) from a single collection (*Verdick 464*) made at Lufaku in Shaba Province, Zaire. This consists of five apical portions of stems and branches each possessing one or two capitula at anthesis most of which have many disc florets with their diagnostic urceolate corollas. De Wildeman (1914a) later published a new species, *B. rubra* De Wild., based on two collections (*Bequaert 389* and *Homblé 563*) from Welgelegen near Lubumbashi in south-easternmost Zaire, very close to the Zambian border. These specimens also possess disc florets with urceolate corollas. De Wildeman observed that *B. rubra* "Verwandlt mit *B. urceolata* De Wild., aber mit schmälere Blättern"! This inadequate reason for maintaining the two as distinct was later amplified (De Wildeman 1914b): "Cette espèce est indiscutablement voisine de notre *B. urceolata*, qui possède des feuilles à lobes beaucoup plus élargis, des tiges paraissant beaucoup plus glabres, des fleurons beaucoup plus larges, généralement à plus de cinq nervures." Sherff (1937) also considered the two species as distinct, employing as his key differences "*Achaenia faciebus glabra; involucri bracteis exterioribus circ. 6-8*" for *B. rubra* and "*Achaenia faciebus pleurumque setosa*" for *B. urceolata*. These supposed distinctions, however, are of little use even to separate the type specimens. Although the broadest leaf lobes of *Verdick 464* are wider than any of those on *Bequaert 389* or *Homblé 563*, many exist on the latter specimens which are as wide as the narrower ones on *Verdick 464*. Further, some of the ray florets on *Homblé 563* are wider than the 4.0-4.5 mm claimed for them by De Wildeman and approach those of *Verdick 464*. The differences adopted by Sherff in his key are even more difficult to justify. The cypselas of the original material of *B. rubra* are indeed glabrous, but so are some of those of *Carson 34*, cited by Sherff for *B. urceolata* and used by him in his description of the cypselas. The inclusion of the number of outer phyllaries in his key strongly implies that this value is of diagnostic importance. This is incorrect. Sherff's description for *B. urceolata* cites the number as 7-14, thus overlapping with that of *B. rubra*. Clearly the separation of *B. rubra* and *B. urceolata* cannot be supported. Wild (1967) suspected this prompting Lisowski (1991) to formally place *B. rubra* within the synonymy of *B. urceolata*.

Bidens leptolepis was published by Sherff (1923) based on a specimen of *Kassner 2725* at B collected on Mt. Kundelungu in Zaire. He considered it "closest in foliage and general habit to" *B. urceolata* but maintained it as distinct due to its "smaller flowering heads, very dark red or dark purple, not light violet ligules, much more slender and elongate external involucre bracts, ordinary (not conspicuously margined above) internal involucre bracts, and [the absence of] a definitely urceolate shape to the tubular florets." This specimen is apparently destroyed but an examination of duplicates of this collection at BM, K, P, and Z has shown that many of the disc floret corollas are in fact decidedly urceolate. Immature florets, by contrast, are more or less campanulate and only appear to be at anthesis due to the pressure exerted

by pressing the specimens causing many of them to open. Sherff (1928) provided an emended description based on material collected by Overlaet from Kafakumba in Zaire near the Angolan and Zambian borders. This reduced the number of differences between *B. urceolata* and *B. leptolepis* particularly with respect to characters of the outer phyllaries. Further collections have demonstrated that of those noted by Sherff the only consistent differences between the two taxa are the size of the capitula and colour of the ray florets. It is also apparent that important differences exist in shape, size, and nervature of the ray florets. These were used by Lisowski (1990), in addition to ray floret colour, as justification for maintaining the two taxa as distinct species. These differences are sufficient to enable flowering specimens of the taxa to be easily and unambiguously determined. They are not adequate, however, to warrant specific separation. The nature and extent of the differences are akin to those used previously (Rayner 1993) to distinguish *B. diversa* Sherff ssp. *diversa* and *B. diversa* ssp. *filiformis* (Sherff) T.G.J. Rayner. In the case of *B. urceolata* and *B. leptolepis*, however, the geographical separation is lacking. This leads inevitably to the conclusion that the two taxa must be recognized as varieties following the traditional use of this category enunciated by Du Rietz (1930).

Bidens urceolata De Wild., Ann. Mus. Congo Belge, Bot. sér. 4, 1:167. 1903.; T. Durand & H. Durand, *Syll. Fl. Ccngol.* 308. 1909.; De Wild., *Notes Fl. Katanga* 2:23. 1913.; De Wild., *Contr. Fl. Katanga* xxxv, 240. 1921.; Sherff, *Field Mus. Nat. Hist.*, Bot. Ser. 16:60, 550, 551, t. 140, f. a-g. 1937.; Wild, *Kirkia* 6:14, 16. 1967.; M.A.E. Richards & W.V. Morony, *Check List Fl. Mbala & Distr.* 182. 1969.; Lisowski, *Bull. Jard. Bot. Belg.* 60:171, 174. 1990.; Lisowski, *Fragm. Florist. Geobot.* 36(1), suppl. 1:131, 148, f. 34. 1991.; Mesfin, *Kew Bull.* 48:440, 449, 495. 1993. TYPE: ZAIRE. Katanga, Lukafu, Apr. 1900, *E. Verdict* 464 (HOLOTYPE: BR).

Annual herbs, to 15-95(-120) cm tall; stems solitary, arising from a short (to 1.3-3.5 cm long) taproot with numerous, mostly unbranched, adventitious roots, erect, 1.2-7.3 mm diam. near base, simple or few to many-branched; stems and branches obtuse to acute angled-tetragonal, sometimes more or less alate especially above, often tertet-tetragonal to terete below, 0.6-2.2 mm diam. beneath peduncles, usually smooth below, more or less shallow sulcate above, rarely striate, pale to dark brown below, green or pale brown above, often tinged purple, sparsely to moderately pilose chiefly on nodes and angles, with to 0.6-1.8 mm long, more or less erect to slightly antrorse, weak, uniseriate, basally several to many-cellular hairs, rarely glabrous, herbaceous or woody toward base; branches more or less ascending to widely divergent. Leaves decussate, petiolate; lamina pinnatipartite to 1-2-pinnatisect, with 3-7

segments, narrowly to somewhat broadly ovate to ovate-trullate or broadly elliptic-trullate in outline, 1.8-9.5(-12.6) cm long \times 0.9-7.8 cm wide, papyraceous, pale to medium green, sometimes tinged purple, glabrous or sparsely pilose chiefly toward base and at margin, with minute (to 0.05-0.20 mm long), more or less antrorse and adpressed, subrigid, few-cellular, basally 1-2-cellular hairs; primary leaf segments opposite, undivided or deeply 1 to few-lobed, 0.7-6.1 cm long \times 0.5-4.3 cm wide; lobes and undivided segments opposite or subopposite, rarely alternate, antrorsely inserted at 30-70° to rachis, narrowly oblong-elliptic to narrowly oblong-ob lanceolate or chiefly the apical lobe spatulate-ob lanceolate, often gradually attenuated toward base, acute to obtuse and often callose-apiculate at apex, entire or rarely sparsely denticulate and sometimes slightly revolute at margin, 0.5-5.2 cm long \times (0.9-)1.3-5.3 mm wide; petioles to 0.3-4.1 cm long \times 0.4-2.1 mm wide, more or less canaliculate especially above, narrowly winged with wings somewhat dilated below, clasping stem at the connate bases, glabrous or sparsely to moderately pilose chiefly on margin towards base; rachis narrowly obtriangular-oblong to narrowly obtriangular, 0.3-2.3 mm wide, flat to slightly canaliculate; uppermost 1-3(-5) leaves often alternate or subopposite, subsessile to petiolate, tripartite or undivided, to 6.1(-8.0) cm long. Capitula radiate, heterogamous, erect, 2.3-7.2 cm diam. \times 0.6-1.5 cm high at anthesis, to 1.8 cm high in fruit, solitary at stem and branch apices or 2-3(-4) in lax cymes; receptacles more or less flat at anthesis, becoming slightly convex in fruit; peduncles to 2.0-19.6 cm long, 0.5-1.8 mm diam. at anthesis, unchanged in fruit, more or less terete to tetragonal or acute angled-tetragonal, shallow to deeply sulcate, glabrous or chiefly toward base of involucre with isolated, to 0.5-1.1 mm long, more or less erect, few to several-cellular, uniseriate, basally 1-2-cellular hairs; ebracteate or with 1-4(-7), alternate, sessile, undivided or rarely tripartite with very short lateral lobes, linear to narrowly obovate and gradually attenuated below, to 0.6-6.8 cm long \times 0.7-3.2(-3.5) mm wide bracts. Involucre broadly campanulate to depressed-hemispheric at anthesis, to cupuliform in fruit, sparsely to usually densely pilose at base, with to 0.3-1.8 mm long, antrorse and incurved or flexuous, few to several-cellular, uniseriate, basally 1-2-cellular hairs, rarely glabrous; outer phyllaries uniseriate to subbiseriate, irregularly inserted, (6-) 7-16(-19), linear and often slightly dilated toward base or narrowly oblong to lanceolate or narrowly ovate-oblong and often gradually attenuated above, acute to obtuse and sometimes shortly apiculate at the usually slightly callose-indurated apex, entire and sometimes inrolled at margin, 4.6-15.3 mm long \times 0.4-1.7 mm wide at anthesis, unchanged in fruit, erect, sometimes spreading at length, papyraceous, pale to dark green, with 4-9, longitudinal, percurrent, at least centrally paired, red-brown nerves, glabrous or more usually sparsely to densely pilose chiefly toward base of dorsal surface, with to 0.4-1.2(-1.4) mm long, antrorse, suberect, incurved, mostly pointed, few to several-cellular, uniseriate, basally 1-2-cellular hairs, and toward apex of margin, with minute

(0.10-0.15 mm long), antrorse, more or less adpressed, few-cellular, uniseriate, basally unicellular hairs; inner phyllaries 1(-2)-seriate, not fused, (5-)7-9(-10), narrowly ovate to ovate-elliptic or narrowly ovate-oblong to oblong-elliptic, often gradually attenuated above from about middle to the acute to obtuse or rarely rounded apex, frequently recurved and finely erose at margin, 4.2-7.9 mm long \times 1.2-3.7 mm wide at anthesis, to 10.8(-11.6) mm long in fruit, erect, membranous, pale purple to red-brown, often somewhat darker toward apex, with a stramineous to pale brown or pale purple, to 0.1-0.7 mm wide margin, with 17-42, dark purple or dark red-brown, close packed, longitudinal, percurrent nerves, glabrous or dorsal face sparsely to densely pilose along the median nerve and sometimes also at base, with 0.2-1.3 mm long, antrorse, more or less erect, incurved, few to several-cellular, uniseriate, basally 1-2-cellular hairs, apex puberulous. Ray florets 4-9(-10), neuter; ovary oblong to narrowly oblong, usually narrowed toward apex, 1.2-5.3 mm long \times 0.3-0.7 mm wide, glabrous or apex and apical 1/2 of margin sparsely setose, with to 0.15-0.30(-0.50) mm long, erect or antrorse, sharply pointed setae, apex laterally biaristate or exaristate, with aristae frequently to 1.3 mm long, style absent; corolla tube 2.4-3.5 mm long, glabrous or most sparsely pubescent; ray pink, pale red, pale violet, very dark red or dark purple tinged with violet, often shaded toward base, moderately to broadly elliptic or elliptic-oblong and abruptly attenuated toward base and apex, or narrowly elliptic or obovate to elliptic-obovate or broadly elliptic-oblancheolate and gradually attenuated toward base and apex, 1.0-3.4 cm long \times 0.5-1.2 cm wide, with (5-)7-18, darker, longitudinal, percurrent nerves, glabrous or sparsely to subdensely pubescent chiefly toward base of ventral surface, with minute (ca. 0.05 mm diam.), subspherical, sessile or shortly stalked, few-cellular glandular hairs; apex subacute to rounded, entire or minutely and irregularly emarginate or 1-3(-5) denticulate, with acute, to 0.4-1.3(-2.5) mm long teeth. Paleae ovate-elliptic or ovate to narrowly oblong-elliptic, narrowly oblong-ovate or linear to narrowly oblong and often gradually to subabruptly attenuated above and below, acute, often sharply so, to sharply acuminate at apex, entire at margin, 4.2-9.6 mm long \times 0.7-2.8 mm wide at anthesis, to 11.5 mm long in fruit, thin and membranous, glabrous or especially the outer puberulous at apex, stramineous or pale stramineous, with 6-38, irregularly paired, longitudinal, percurrent, red-brown nerves. Disc florets 11-52; corolla yellow, often red, purple, violet or pink above, margin of lobes and nerves usually brown, glabrous; limb urceolate, 2.9-4.3 mm long \times 1.4-3.1 mm diam., not annularly thickened, apex 5-lobed; lobes erect or spreading to revolute, triangular, acute at apex, 0.8-1.3 mm long \times 0.6-0.7 mm wide, papillate at apex; limb abruptly attenuated below into a narrow, 1.8-2.7 mm long \times 0.25-0.35 mm diam., terete tube; anthers 1.9-3.5 mm long \times 0.6-0.7 mm diam., pink, red or light to dark brown, usually exerted to 2.2 mm from corolla; endothecial tissue with polarized thickening; apical appendages ovate-triangular to broadly ovate-triangular, acute to

shortly acuminate at apex, 0.40-0.55 mm long \times 0.25-0.35 mm wide, with a darker, red-brown or brown, percurrent, central nerve, margins recurved; basal appendages sagittate, not or just reaching or greatly exceeding base of the filament collar; collar 0.25-0.35 mm long \times 0.10-0.15 mm wide; filament 1.1-1.8 mm long, flat, margins involute; style 6.8-10.3 mm long, filiform, with caudate, 1.0-1.7 mm long branches; stylopodium cupuliform. Cypselas un-winged; body elliptic to narrowly elliptic-oblong or narrowly oblong to linear and slightly attenuated above and below, 3.8-13.2 mm long \times 0.9-1.8 mm wide, the outer generally shorter and broader, dull or shiny, dark brown to grey-black, strongly compressed, often flattened near apex; dorsal face slightly convex to rounded carinate especially medially; ventral face flat to slightly concave; both faces (6-)8-10-sulcate, glabrous or sparsely setose, with to 0.10-0.15 mm long, antrorse, adpressed to rarely suberect, pointed, occasionally bifurcate, stramineous to dark red-brown setae; margins sparsely to densely setose especially below, with 0.15-0.30(-0.40) mm long, antrorse, mostly adpressed, rarely incurved, pale stramineous setae; apex erect setose, laterally biaristate or the outer exaristate; aristae erect to slightly or more rarely widely divergent, stiff, fragile, subulate, stramineous, to 1.1-2.4 mm long \times ca. 0.1 mm wide at base, retrorsely barbed especially in apical half, barbs to 0.15-0.35 mm long; base of cypselas with a 0.50-0.75 mm long, slightly dorsally produced, rounded-rhombic, cartilaginous carpodium.

FLOWERING. Late March to mid July and sporadically at other times.

HABITAT. Open to dense, usually dry *Brachystegia* woodland on red or grey compacted lateritic or sandy soils; frequently associated with *Marquesia* and *Uapaca*; rarely amongst boulders, in secondary grassland or along roadsides. Alt. 910-2200 m.

Bidens urceolata De Wild. var. *urceolata*

Bidens rubra De Wild., Repert. Spec. Nov. Regni Veg. 13:203. 1914.; De Wild., Notes Fl. Katanga 4:111. 1914.; De Wild., Contr. Fl. Katanga 240. 1921.; Sherff, Field Mus. Nat. Hist., Bot. Ser. 16:60, 548, t. 140, f. h-o. 1937.; A. Schmitz, Publ. Inst. Natl. Étude Agron. Congo Belge, Sér. Sci. 113:371. 1971. TYPE: ZAIRE. Welgelegen, 2 May 1912, J.C.C. Bequaert 389 (LECTOTYPE [selected by Sherff 1937]: BR; excl. Isolectotype: BR).

Bidens leptolepis Sherff forma *pallida* Sherff, Amer. J. Bot. 42:563. 1955. TYPE: ZAMBIA. Kawambwa and Chiengi Dists., Lake Mweru, May 1931, E.G. Walter 21 (HOLOTYPE: K).

Capitula 3.2-7.2 cm diam. at anthesis. Ray florets pink, pale red or pale violet, often shaded darker toward base; ray narrowly elliptic or obovate to

elliptic-obovate or broadly elliptic-oblancoolate, very gradually attenuated toward base, gradually attenuated toward apex, 1.5-3.7 cm long, with (5-)7-9 nerves; apex subacute to obtuse.

SPECIMENS EXAMINED: ZAIRE. Kasai Oriental Province - Luilu river [ca. 06° 20' S 23° 50' E-07° 20' S 23° 40' E], 17 Dec. 1959, *P. Duvigneaud 4653* (BRLU). Shaba Province - Welgelegen [12° 05' S 27° 31' E], 2 May 1912, *J.C.C. Bequaert 389* (BR); plateau between Lakes Tanganyika and Mweru [ca. 06° 50'-08° 20' S 28° 45'-30° 15' E], 1894, *A. Carson 34* (K); Pweto [08° 28' S 28° 54' E], Mar. 1896, *G. Descamps s.n.* (BR); Lufonzo river, Kisabi [08° 03' S 29° 11' E], Mar. 1896, *G. Descamps s.n.* (BR); Mitwaba [08° 37' S 27° 20' E], alt. 1600 m, Feb. 1953, *R. Desenfans 2444* (BRLU[2 sheets]); Mitwaba [08° 37' S 27° 20' E], alt. 1600 m, Feb. 1953, *R. Desenfans 2452* (BRLU); *s. acc. loc.*, alt. 1500 m, 17 Apr. 1953, *R. Desenfans 3005* (BRLU[2 sheets]); summit of the Kundelungus, toward the Lukafu river valley [ca. 10° 30' S 27° 35' E], 10 Jul. 1947, *P. Duvigneaud 1295* (BRLU); Musoshi [11° 55' S 27° 47' E], 6 Jun. 1957, *P. Duvigneaud 3423* (BRLU); Musoshi [11° 55' S 27° 47' E], 5 Jun. 1957, *P. Duvigneaud 3427* (BRLU); Massif de la Luina [ca. 09° 10'-09° 20' S 24° 30'-24° 45' E], 21 Jun. 1957, *P. Duvigneaud 3614* (BRLU); *s. acc. loc.*, 21 Jun. 1957, *P. Duvigneaud 3620* (BRLU); Kinika to Kilwa road between Kipaska and Murobi [09° 18' S 28° 25' E-10° 28' S 28° 08' E], 23 Jun. 1957, *P. Duvigneaud 3649* (BRLU); *s. acc. loc.*, 1957, *P. Duvigneaud 3679* (BRLU); between Pweto and Kapulo [ca. 08° 18' S 29° 15' E-08° 28' S 28° 54' E], 1957, *P. Duvigneaud 3695* (BRLU); Welgelegen [12° 05' S, 27° 31' E], 2 May 1912, *H.A. Homblé 563* (BR[2 sheets]); Lukifwa river [ca. 08° 00' S 29° 06' E], 24 May 1908, *T. Kassner 2859a* (BM); Kundelungu plateau, near the Lofoi river [ca. 10° 10'-10° 30' S 27° 30'-27° 50' E], alt. 1500 m, 27 Mar. 1971, *S. Lisowski 84860* (POZG); Kibara plateau, around Lusinga [ca. 08° 56' S, 27° 12' E], alt. 1780 m, 14 Apr. 1969, *S. Lisowski 88373* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1700 m, 14 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 4527a* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1720 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 4534* (BR,POZG); Kibara plateau, around Lusinga, near Kanjimbwe pond [ca. 08° 59' S 27° 06' E], alt. 1820 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 4726* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1800 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 5202b* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1680 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 5214* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1720 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 5222* (POZG); Kibara plateau, near Lusinga [ca. 08° 56' S 27° 12' E], alt. 1720 m, 15 Apr. 1969, *S. Lisowski, F. Malaisse, & J.-J. Symoens 5310* (POZG); Kundelungu plateau, ca. 12 km N of the western source of the Lutshipuka river, near the R.A.C.K. lodge [ca. 08° 52' S 27° 14' E], alt. 1680 m, 30 May 1969, *S. Lisowski, F. Malaisse, &*

J.-J. Symoens 5803 (BR,POZG); Kundelungu plateau, ca. 20 km S of Luishi [ca. 09° 54' S 27° 44' E], alt. 1700 m, 23 Apr. 1970, *S. Lisowski, F. Malaisse, & J.-J. Symoens 10910* (BR,POZG); Kundelungu plateau [09° 20'-10° 40' S 27° 40'-28° 00' E], 25 Apr. 1970, *S. Lisowski, F. Malaisse, & J.-J. Symoens 11125* (POZG); Kundelungu plateau, near Lofoi falls [ca. 10° 14' S 27° 30' E], alt. 1550 m, 27 Mar. 1971, *S. Lisowski, F. Malaisse, & J.-J. Symoens 13254* (BR,POZG); Kundelungu plateau, around Kaloba falls [ca. 10° 16' S 27° 36' E], 25 May 1984, *F. Malaisse 13139* (BR); Kundelungu Mts., [09° 20'-10° 40' S 27° 40'-28° 00' E], Jul. 1939, *P. Quarré 5607* (BR); Kundelungu foothills, Lukafu [10° 31' S 27° 37' E], 16 Jul. 1948, *A. Schmitz 1896* (BR); 100 km S of Lubumbashi, near Kasumbalesa [ca. 12° 12' S 27° 48' E], 26 Mar. 1951, *A. Schmitz 3519* (BR); Mukulakulu [09° 33' S 25° 48' E], 29 Apr. 1953, *de Troyer 80* (BR); Lukafu [10° 31' S 27° 37' E], Apr. 1900, *E. Verdick 464* (BR); Upemba National Park, Munte river bridge road [ca. 08° 45' S 26° 50' E], alt. 1650 m, 25 Apr. 1959, *J. de Wilde 741* (BR); Upemba National Park, track towards Mitwaba [ca. 08° 37' S 27° 20' E], alt. 1550 m, 12 Apr. 1947, *G.F. de Witte 2487* (BR); Upemba National Park, head of the source of the Kalumengongo river [08° 58' S 27° 56' E], alt. 1830 m, 31 Mar. 1949, *G.F. de Witte 5961* (BR,PRE).

ZAMBIA. Luapula Province - edge of escarpment on road to Mwense from Mansa [ca. 10° 25' S 28° 45' E], 3 May 1968, *J. Anton-Smith Z.M. 98* (EA); Kawambwa [09° 45' S 29° 01' E], 25 Aug. 1957, *D.B. Fanshawe 3614* (K); Mansa, on escarpment [11° 10' S 28° 52' E], 3 May 1964, *D.B. Fanshawe 8519* (K); Kawambwa Dist., in Kapweshi P.F.A. [09° 50' S 28° 50' E] and Kawambwa [09° 45' S 29° 01' E], 19 May 1962, *R.M. Lawton 856* (K); Kawambwa and Chiengi Dists., Lake Mweru [ca. 08° 20'-09° 20' S 28° 20'-29° 10' E], alt. 910-1220 m, May 1931, *E.G. Walter 21* (K). Northern Province - Mporokoso Dist. [ca. 08° 50'-09° 40' S 29° 10'-30° 40' E], alt. 1200 m, 4 Apr. 1957, *M.A.E. Richards 9018* (K); Mporokoso Dist., Mweru-Wantipa, road to Bulayo [ca. 08° 50' S 29° 40' E], alt. 1050 m, 12 Apr. 1957, *M.A.E. Richards 9188* (BR,K,P,UZL). North-Western Province - Mwinilunga Dist., source of the Zambezi [ca. 11° 10' S 24° 12' E], 19 May 1969, *J.M. Mutimushi 3240* (K).

***Bidens urceolata* De Wild. var. *leptolepis* (Sherff) T.G.J. Rayner, *comb. et stat. nov.* BASIONYM: *Bidens leptolepis* Sherff, Bot. Gaz. 76:85, t. 9, f. a-g. 1923.; De Wild., *Contr. Fl. Katanga*, suppl. 1:96. 1927; Sherff, Bot. Gaz. 85:12. 1928.; De Wild., *Pl. Bequaert.* 5:465. 1932.; Sherff, Field Mus. Nat. Hist., Bot. Ser. 16:60, 551, t. 138, f. j-p. 1937.; Lisowski, Bull. Jard. Bot. Belg. 60:171, 174. 1990.; Lisowski, *Fragm. Florist. Geobot.* 36(1), suppl. 1:131, 150, f. 35. 1991. TYPE: ZAIRE. Mt. Kundelungu, 10 May 1908, *T. Kassner 2725* (HOLOTYPE: B†;**

LECTOTYPE [selected by Rayner 1992]: Z; Isolectotypes: BM,K,P).

Bidens overlaetii Sherff nom. ined. in sched. quoad F.G. Overlaet s.n. (F).

Capitula 2.3-3.6 cm diam. at anthesis. Ray florets very dark red or dark purple tinged with violet; ray moderately to broadly elliptic or elliptic-oblong, abruptly attenuated toward base and apex, 1.0-1.7 cm long, with (9-)10-18 nerves; apex rounded.

SPECIMENS EXAMINED: ZAIRE. Shaba Province - Kundelungu Park, Kaloba falls [10° 16' S 27° 36' E], 25 May 1984, *H. Breyne 4859* (BR); Lupweji river, 162 km along road from Kamina to Kolwezi [09° 40' S 24° 40' E], 24 Jun. 1956, *J. Brynaert 487* (BR); Kiongwe [08° 27' S 27° 45' E], alt. 1300 m, 15 May 1953, *R. Desenfans 3285* (BRLU); Kiongwe [08° 27' S 27° 45' E], alt. 1300 m, 19 May 1953, *R. Desenfans 3332* (BRLU); 20 km E of Kisenge [10° 42' S 23° 22' E], 1957, *P. Duvigneaud 2317* (BRLU); 8 km from Kisenge towards Divuma [10° 40' S 23° 06' E], 1957, *P. Duvigneaud 2329* (BRLU); Kasekelesa [10° 39' S 24° 56' E], 16 May 1957, *P. Duvigneaud 3174* (BRLU); Mt. Kundelungu [09° 20'-10° 40' S 27° 40'-28° 00' E], 10 May 1908, *T. Kassner 2725* (BM,K,P,Z); 20 km E of Dubie [08° 34' S 28° 43' E], alt. 1150 m, 18 May 1971, *S. Lisowski 84857* (BR,POZG[3 sheets]); Kafakumba [09° 41' S 23° 44' E], Apr. 1925, *F.G. Overlaet s.n.* (F,K); Kisenge [10° 42' S 23° 10' E], 26 Apr. 1959, *S. Risopoulos 977* (BR); Kamina to Kabongo road, Kapemba [08° 05' S 25° 10' E], 7 Apr. 1948, *A. Schmitz 1605* (BR); Marungu Mts., Kasiki [07° 37' S 29° 55' E], alt. 2200 m, 12 Jun. 1939, *P. Vanden Brande s.n.* (BR); Upemba National Park, Kibara Mts., valley of the Kalumengongo river, near Mvidi ya Mvule falls [ca. 08° 20' S 27° 15' E], alt. 1330 m, *G.F. de Witte 6074* (BR).

ZAMBIA. North-Western Province - 80 km W of Solwezi [12° 11' S 25° 33' E], alt. 1350 m, 15 Apr. 1960, *E.A. Robinson 3541* (EA,K,M[2 sheets],SRGH); Mwinilunga Dist., 35 km N of Kabompo Gorge [11° 43' S 25° 15' E], 19 Apr. 1965, *E.A. Robinson 6651* (B,BR,EA,K,M).

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